X-ray Fluorescence Microprobe (XFM)

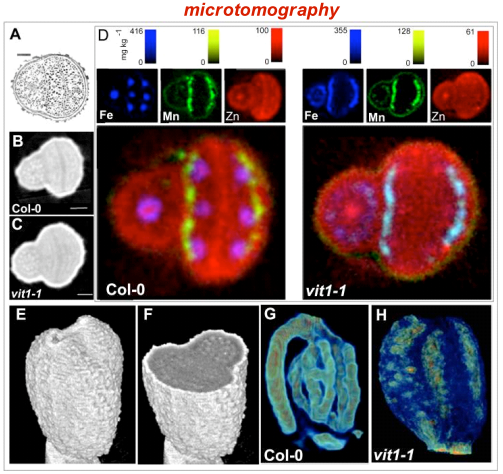
XFM at NSLS-II

- Will provide spatially-resolved characterization of elemental abundances and speciation in “as-is” samples at µm scale with high throughput. Crucial for biological screening.
- Optimized for microfocused extended x-ray absorption fine structure (µEXAFS) spectroscopy; 4 to 20 keV.
- Capabilities for NSLS-II’s three pole wigglers excellent sources for µEXAFS and XFM will provide in a 1-10 µm beam flux densities **two orders of magnitude higher** than at the NSLS. This will be world-leading for full µEXAFS.

Examples of Science Areas & Impact

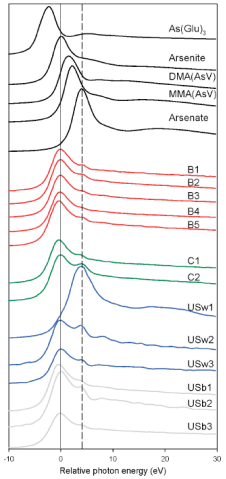
- Molecular speciation of contaminants in the environment at the microscale
- Genetic control of metal ion uptake, transport and storage in plants relevant to agriculture and bioenergy
- Biogeochemistry of nanotoxins in the environment
- Metal ions in health and disease
- Mineral-fluid interface reactions relevant to carbon sequestration
- Early solar system properties inferred through analysis of extraterrestrial materials
- Characterization of paleontological, archeological and cultural heritage artifacts

3D in-vivo imaging of metals in Arabidopsis using fluorescence microtomography



Kim, et al., Science, 2007

As XANES spectroscopy from rice



Meharg et al., ES&T, 2008

XFM is well-suited for evaluation of how specific genes influence the uptake of nutrients and contaminants in plants. It will provide non-destructive, three dimensional characterization in-vivo with high throughput. XFM’s strengths in µEXAFS can evaluate how chemical form influences bioavailability or toxicity.

Beamline Capabilities

TECHNIQUE(S): µm x-ray fluorescence (XRF), x-ray absorption fine structure (XAFS) spectroscopy, x-ray diffraction (XRD) and fluorescence computed microtomography (FCMT)

SOURCE: three-pole wiggler

ENERGY RANGE / RESOLUTION: 4 to 20 keV / 1 eV

SPATIAL RESOLUTION: 1 – 10 µm variable

U.S. DEPARTMENT OF ENERGY

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